REMARKS

Applicants appreciate the consideration shown by the Office as evidenced by the Office Action mailed on January 30th, 2007. In that Office Action, the Examiner rejected claims 1, 2, 4-10, 13-16, 18-24, 27-34. In this response, claims 7, 12, 21, and 26 are canceled. Claims 1, 2, 4-6, 8-10, 13-16, 18-20, 22-24, and 27-34 remain pending in the present patent application. In view of the following remarks, Applicant requests further examination and reconsideration of the present patent application.

Claim Rejections

Claims 1, 2, 4-10, 13-16, 18-24, 27-34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Takada et.al. U.S. Patent Application number 2006/0048866 (Hereafter "Takada".) The applicant respectfully traverses these rejections.

A description of some of the embodiments of the present invention has been provided in the previous Response and thus will not be repeated here. Applicants respectfully submit that the applied reference does not disclose, teach, suggest, or motivate the invention recited in amended independent claims 1 and 15 and their respective dependent claims. In particular, the applied references fail to teach, suggest, or motivate a molybdenum-based nanocomposite comprising a plurality of nanoparticles having at least one dimension in a range from about 10 nanometers to about 500 nanometers, wherein said plurality of nanoparticles comprises from about 2 volume percent to about 20 volume percent of said molybdenum-based nanocomposite; and wherein each of said plurality of nanoparticles comprises at least one of an inorganic oxide, an inorganic carbide, an inorganic boride, an inorganic oxycarbide, an inorganic oxynitride, an inorganic silicide, an inorganic aluminide, and combinations thereof.

In Applicants' previous response filed 22 December 2006, Applicants argued that there is a clear distinction made in Takada between the nitride "nano-size" particles (See Takada, Figure 1) formed during nitriding and the other (oxide, carbide, or boride) "particles" dispersed throughout the material by some other process, and thus the other particles cannot be fairly construed to be "nanoparticles" as recited in the claims of the present application. In the subject Final Office Action, the Examiner responded that this argument was not persuasive because (1) "it is not clear what particular numerical size range(s) would define the term "nanoparticles;" and

(2) nothing is ever mentioned in Takada as to the size of the oxide, boride, or carbide particles (hereafter referred to as "the other particles"), leading to the conclusion that Takada encompasses "embodiments in which these particles are of a size that would be considered to be nanoparticles within the limitations of the instant claims."

Applicants respectfully disagree with the Examiner, and offer the following remarks on each of these two points to clarify their reasoning as to why they believe the present claims as now amended recite subject matter that is allowable over Takada. In short, Applicants respectfully submit that **the size range defining the term "nanoparticles" is clearly defined** and explicitly recited in amended claims 1 and 15, and that **Takada's silence** on the size of the other particles, coupled with the description of the properties of the material comprising only these other particles (i.e., nitride-free material in Takada), would not lead one of ordinary skill in the art to the material having particles with the size range and loading recited in the present claims.

Finally, Applicants also contend that Takada **does not sufficiently enable** one of ordinary skill in the art to provide a plurality of nanoparticles of the types recited in claims 1 and 15 at the loading levels recited therein.

Applicants respectfully request the Examiner's reconsideration of the rejection in light of these remarks.

(1) Size range of "Nanoparticles" is clearly defined.

The independent claims 1 and 15 have been amended to recite clearly the size range set forth in the instant specification to define "nanoparticles": 10 - 500 nm. See, for example, paragraph [0019] of the present specification.

(2) Takada cannot fairly be construed to teach the limitations of nanoparticle size and loading recited in the instant claims.

Takada clearly differentiates between "nanoparticles" and "particles." It should be noted that in Takada, paragraph [0024], it is stated that there are "at least two kinds of precipitated fine particles, namely nitride nanoparticles 2 dispersed in the surface region of a worked material 1

and particles 3 composed of at least one of carbide particles, oxide particles, and boride particles." In paragraph [0036] these nanoparticles are described as having a size that is consistent with Applicants definition of nanoparticles: thickness of 10 nm and length of 50nm. Moreover, in paragraph [0034] of Takada it is disclosed that the nitride nanoparticles are able to pin grain boundaries, while paragraph [0042] is an example the other particles do not have this property, indicating, as will be demonstrated below, that these other particles are substantially larger than the nanoparticles.

Applicants and the Examiner appear to agree that Takada is silent as to the size of the other particles in the material. However, Applicants respectfully disagree with the Examiner's conclusion that Takada necessarily encompasses "embodiments in which these particles are of a size that would be considered to be nanoparticles within the limitations of the instant claims." First, there is clear evidence in Takada that the size range of these other "particles" is substantially larger than that of Takada's nitride "nanoparticles." To be specific, the fact that it is the nitride nanoparticles, and not the other particles, that achieve pinning of the grain boundaries in the worked structure (see paragraph [0034], second sentence et seq.) is indicative to one of ordinary skill in the art that the other particles must be substantially larger than the nanoparticles. The well-known Zener-Smith relationship, for example, demonstrates that the maximum grain size stabilized by a dispersion of particles is directly proportional to the size of the particles. In short, fine particles generally maintain a finer grain size than coarser particles, for otherwise equivalent dispersions. See, for example, http://en.wikipedia.org/wiki/Zener_pinning, where it is shown that the pinning pressure exerted by a dispersion of particles on a boundary is inversely proportional to the particle size.

One skilled in the art, seeing in Takada that the nitride nanoparticles are effective grain boundary pinning agents and that the other particles are not, would thus conclude that the other particles were substantially more coarse than the nitride nanoparticles. Certainly there is nothing in Takada that remotely suggests using oxides, borides, or carbides having nano-scale particle sizes. Thus it would be pure speculation to assume that Takada encompassed embodiments where the other particles have sizes in the 10 nm - 500 nm range.

Second, there is no suggestion that the loading of the other particles is in the range recited by the instant independent claims (about 2 to about 20 volume percent). Takada describes two methods for forming other particles. The first is found in paragraph [0027]; a solution

decomposition process to form a lanthanum oxide dispersion in molybdenum (Mo). The process results in a dispersion of 1.0 weight percent lanthanum oxide particles in Mo, which is equivalent to 1.5% lanthanum oxide by volume. This is the only quantitative description of the loading of other particles in the material of Takada. In the second method, carbide dispersions are described in paragraph [0028] as being made by mechanical alloying with a ball mill, followed by hot isostatic pressing. This is the very approach described in the present specification, paragraph [0025], which is described as typically limiting the loading of the dispersion to values under 2 volume percent. Again, the evidence in Takada does not support the conclusion that Takada encompasses embodiments where particle loadings are within the range recited in the instant claims.

Takada thus fails to teach, suggest, or disclose a plurality of nanoparticles of the types recited in claim 1, where the particles comprise from about 2 to about 20 volume percent of the material.

(3) Lack of enablement in Takada

To render a later invention unpatentable for obviousness, the prior art must enable a person of ordinary skill in the field to make and use the later invention. Beckman Instruments, Inc. v. LKB Produkter AB, 892 F.2d 1547, 1551 (Fed. Cir. 1989). Here, Takada lacks a disclosure of sufficient detail to enable one of ordinary skill in the art to make the invention recited in the instant claims. First, there is no disclosure as to a size range for particles other than the nitride nanoparticles, which, as detailed above, are clearly much finer than the other particles. Second, there is no disclosure of any method that would result in the formation of nanoparticles at the loading recited in the instant claims. The only method disclosed for making nano-scale particles is nitriding, which by its very nature only forms nitride particles. The mechanical alloying technique described in Takada, paragraph [0028], is insufficient to allow a dispersion of nanoparticles throughout the material at the loading levels recited in claims 1 and 15. See the present specification, paragraph [0025]. Certainly there is no suggestion in Takada that nanoparticles can or should be formed by these mechanical alloying techniques. The solution-decomposition process described in Takada, paragraph [0027], creates particles having loadings of just 1.5% by volume, and there is no description of the size of the particles formed. Takada simply lacks many key details needed to enable one of ordinary skill in the art to make the

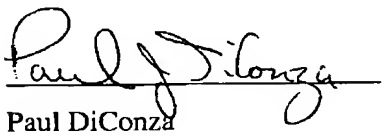
invention recited in the instant claims.

In view of these shortcomings of Takada, Applicants respectfully submit that the instant claims as amended are now allowable over Takada. Applicants respectfully request reconsideration and allowance of these claims.

Conclusion

In view of the remarks and amendments set forth above, Applicant respectfully requests allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,



Paul DiConza
Reg. No. 48,418
General Electric Company
Building K1, Room 3A60
Telephone: (518) 387-6131

Niskayuna, New York
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